

In claim 75, line 4, delete "base sheet".

In claim 75, line 15, delete "ceramic" and substitute thereat --material--.

In claim 79, line 2, delete "thereto" and substitute thereat --to the base sheet--.

In each of claims 79 and 80, line 1, delete "20" and substitute thereat --75--.

IN THE SPECIFICATION

Please amend the specification as follows:

At page 6, line 26, insert --and are metalized using a suitable electrode metal which
may be used for plating such as an alloy of nickel and chromium-- following the words "wall
height".

REMARKS

The claim amendments, the enclosed copies of certain foreign patent documents, and the remarks provided herein are submitted as a result of the several interviews with the examiner in this application.

Telephonic Interview Summary

The applicants wish to thank the examiner for his thorough attention to this matter and for the several telephone interviews conducted on August 16, August 22, and August 24,

2000, discussing various issues in the case. This amendment and response addresses each of the issues discussed during the interviews.

Timing of Amendment and Response

The present amendment is proper and is submitted for good and sufficient reason as required under 37 CFR §1.116(b). These amendments are submitted now based upon continuing discussions and an agreement with the examiner in this case. This amendment is also timely filed since no decision on the pending appeal has yet been rendered.

Cancellation of Method Claims 46-58

Claims 46-58 have been cancelled according to an agreement with the examiner. Cancellation of these claims is made without prejudice whereby the applicants reserve the right to submit a timely filed divisional or continuation application incorporating the subject matter of these cancelled claims.

Amendment of Method Claims 20-33

Method claims 20-33 are to be rejoined for consideration in this application. Independent claim 20 has been amended to incorporate changes made to a corresponding apparatus claim during previous prosecution in this application. Independent claim 20 has been further amended to correct minor informalities and typographical errors within the claim.

Dependent claims 21-33 have also been amended to incorporate proper form and to correct minor informalities and typographical errors. Method claims 20-33 are now believed to be in condition for allowance.

Amendment of Dependent Apparatus Claims 35-45

Claims 35-45 depend from allowable independent claim 34, all of which were also noted as being in condition for allowance. These claims have been amended to correct minor informalities and typographical errors noted during a review of the claims. Independent claim 34 has not been amended herein. Therefore claims 34-45 remain in condition for allowance.

Amendment of Dependent Apparatus Claims 60-66

Claims 60-66 depend from allowable independent claim 59, all of which were also noted as being in condition for allowance. These claims have been amended to correct minor informalities and typographical errors noted during a review of the claims. Particularly, claims 65 and 66 have been amended to properly depend from independent apparatus claim 59, correcting an obvious typographical error in claim dependency. Claim 59 has not been amended herein. Claims 59-66 therefore remain in condition for allowance.

Amendment of Copied Method and Apparatus Claims 67-74

Claims 67-74 were indicated as being allowable during the most recent interview with the examiner. These claims have been amended merely to correct minor informalities and typographical errors noted during a review of the claims. Specifically, an obvious typographical error has been corrected in claim 69 and in claim 73. Minor improper antecedent basis language has been corrected in claims 72 and 74. Claims 67, 68, 70, and 71 have not been amended herein. Claims 67-74 are therefore also now in condition for allowance.

Amendment of Apparatus Claims 75-80

Independent claim 75 and dependent claims 79 and 80 have been amended herein to correct minor informalities that were previously made in unentered Amendment C submitted February 14, 2000. Claims 79 and 80 were cancelled in the Amendment D submitted with the Appeal Brief on July 31, 2000. However, Amendment D has not been entered according to the most recent interview with the examiner. Therefore, claims 79 and 80 are not cancelled in this application, but are merely withdrawn, and are to be rejoined in the application. These claims have been amended herein to incorporate proper dependency from claim 75. Claims 75-80 are therefore believed to be now in condition for allowance.

Re-submission of Documents Submitted with IDS of September 29, 1995

As requested by the examiner, copies of four foreign patent documents and one printout document have been provided along with this amendment. The examiner noted that these five documents, though submitted in an Information Disclosure Statement on September 29, 1995, were not previously considered. Copies of these documents are missing from the Patent Office file. Courtesy copies of these five documents are therefore provided herewith.

Support for Copied Claims 67-74

As previously noted during prosecution in this application, claims 67-74 have been copied from U.S. Patent No. 5,598,196, assigned to Eastman Kodak Co., in order to provoke an interference. The examiner has requested that the applicants identify portions of the instant application that provide support for the copied claims.

Copied Claim 67

Claim 67 is copied from claim 1 of the Kodak patent and includes three subparagraphs (a) - (c). Figure 2 and page 5, lines 21-23 of the instant application as originally filed disclose a body of piezoelectric material 12 that has a plurality of parallel open-topped channels 11(a) - 11(h) that are separated by walls 13(a) - 13(g). The walls are disclosed within Figure 2 and at page 6, lines 25-26 as having electrodes 23 on opposite sides of the walls. The walls are disclosed at page 5, lines 18-20 as forming a mode actuators for effecting droplet expulsion from the channels. As noted below in greater detail with regard to claim 68, the electrodes are described as being metal at page 6, line 26, in the instant specification, *as amended herein*. Therefore, the limitations of claim 67, paragraph (a) are fully supported within the originally filed specification.

Figures 1 and 2 and page 5, line 24 through page 6, line 1 disclose a top cover or channel closure sheet 14 with a pattern of parallel metal conductors 16 aligned with the open-topped channels and extending beyond the body 12 in a direction parallel with the channels (see Figure 1 in particular). It is implicit for a printed-circuit substrate of this kind that the channel closure sheet 14 is an insulating material, but this feature is also further supported by the last full paragraph of page 10. Support for the limitations of claim 67, paragraph (b) is also found within the instant specification as originally filed.

Figure 2 and page 7, lines 16-20 disclose that the top cover or closure sheet 14 is attached to the body 12 by solder joints 28 between the conductors 16 and the electrodes 23, whereby the conductors provide electrical contact to the electrodes. Support for the limitations of claim 67, paragraph (c) is also found in the originally filed specification.

Support for combining each of the limitations of claim 67 is also found within the original specification. The above-noted specification excerpts and Figures 2 and 3 disclose the assembled apparatus as claimed.

Copied Claim 68

Claim 68 is copied from Claim 2 of the Kodak patent. Claim 68 recites that the electrical or metal conductors and electrodes found in claim 67 are nickel and that the solder joints found in claim 67 are of an indium bismuth solder. European Patent Application No. 89309940.8 (publication No. 0 364 136) is incorporated by reference at page 6, lines 22-23 of the instant application. This publication suggests an alloy of nickel and chromium as a suitable electrode metal (see column 6, lines 31-32 of the noted European Patent Application document).

The instant application was amended in a preliminary amendment filed on September 29, 1995 along with the application changing reference to the above-noted European Patent Application to reflect its corresponding issued U.S. Patent No. 5,016,028. Therefore, this recitation in the originally filed application now incorporates by reference the contents of the U.S. Patent 5,106,028. In that regard, the specification of the instant application has been amended herein to incorporate language found directly within this patent 5,016,028 suggesting an alloy of nickel and chromium as a suitable electrode metal for the side wall electrodes. Therefore, where necessary herein, reference is now made to the instant specification at page 6, line 26, where this language has been added, instead of the European Patent Application or its corresponding U.S. Patent 5,016,028. Amendment to the instant specification is proper because the language added herein was originally found in the documents incorporated by reference.

Page 7, line 24 of the instant application suggests, among others, a suitable alloy of indium for the solder joints. The nickel and indium recited in copied claim 68 are therefore adequately supported by the instant specification as originally filed.

Support for combining the materials recited in claim 68 with the apparatus of claim 67 is inherent in the noted disclosures. Nickel is suggested for electrodes of an ink jet print head apparatus and indium is suggested for the solder joints of claim 67.

Copied Claim 69

Claim 69 is copied from claim 3 of the Kodak patent and recites an orifice plate over one end of the channels for ejecting droplets of ink from the channels. Figure 1 of the instant application discloses the apparatus of claim 67 including an orifice plate or nozzle plate 20 over one end of the channels 11 (a)-11(h) for ejection of droplets of ink therefrom. The plate 20 is further described at page 6, lines 10-13. Adequate support for copied claim 69 is therefore found in the instant specification as originally filed. In addition, support for combining this orifice plate with the apparatus of claim 67 is found in Figure 1 which shows a side view of the apparatus of Figure 2 and shows the nozzle or the orifice plate at the channel ends.

Copied Claim 70

Claim 70 is copied from claim 6 of the Kodak patent and includes sub-paragraphs (a)-(f). Page 2, lines 22-26 of the instant specification disclose the step of forming a body of piezoelectric material having a plurality of parallel open-topped channels separated by walls. Therefore, paragraph (a) of copied claim 70 is adequately supported by the present specification.

Page 2, lines 25-26 disclose the step of forming electrodes on opposite sides of the walls. As amended herein, the present specification at page 6, line 26 describes the side wall electrodes as metal electrodes. Therefore, the limitations of claim 70, paragraph (b) are adequately supported by the instant specification.

Page 3, lines 2-4 disclose forming a top cover or channel closure sheet 14 having a pattern of parallel metal conductors congruent with the open tops of the channels. Therefore, the limitations of claim 70, paragraph (c) are adequately supported by the instant specification.

Page 3, lines 12-13 disclose the step of coating the electrodes and conductors with solder. Therefore, the limitations of claim 70, paragraph (d) are adequately supported by the instant specification.

Page 7, lines 13-15 disclose the step of placing the top cover or closure sheet on the body. Therefore, the limitations of claim 70, paragraph (e) are also adequately supported by the instant specification.

Page 7, lines 16-20 disclose the step of reflowing the solder to bond the top cover or closure sheet to the body. This step will implicitly entail heating the top cover and body in order to reflow the solder. Therefore, the limitations of claim 70, paragraph (f) are adequately supported by the instant specification.

Combining each of these steps recited in claim 70 is inherent in the instant specification. Particularly, Figures 1-3 disclose the ink jet print head recited in claim 67 which is assembled by utilizing the steps disclosed in claim 70. Further, page 2, line 22 through page 3, line 13 and page 7, lines 13-20 describe assembling the apparatus as disclosed in Figures 1-3.

Copied Claim 71

Claim 71 is copied from claim 8 of the Kodak patent and discloses the further step of bonding an orifice plate over one end of the channels in the body. Page 6, lines 10-13 of the instant specification disclose the step of bonding an orifice plate or nozzle plate 20 over one end of the channels in the body. As discussed previously referring to claim 69, Figure 1 shows a side view of the apparatus of Figures 2 and 3 and shows the orifice plate as bonded to the apparatus manufactured using the method recited in claim 70. Therefore, adequate support for the step of claim 71 and for combining the step with those of claim 70 are found within the instant specification as originally filed.

Copied Claim 72

Claim 72 is copied from claim 9 of the Kodak patent and includes sub-paragraphs (a) and (b). Figures 1-3 of the instant specification illustrate a piezoelectric ink jet printhead 10 that includes a sheet of piezoelectric material poled in a direction normal to the sheet. This feature is also described at page 5, lines 18-20 of the instant specification. The piezoelectric material also defines a plurality of parallel channels 11(a)-11(h) that are mutually spaced in an array direction normal to the length of the channel. This feature is described at page 5, lines 18-23. Each channel is shown and described as being defined by a facing side wall 13(a)-13(g) and a bottom surface extending between the respective side walls. This is shown in Figure 2. Each of the side walls is also shown and described as including side electrodes 23 on opposite sides of the walls in order to form shear mode actuators for effecting droplet expulsion from the channels. See Figure 2 and page 5, starting at lines 18. Each side electrode extends along the length of the corresponding side wall. This is implicit in Figure 2 of the instant application and is explicitly described at page 7, lines 2-3 of the instant

application. Therefore, all of the limitations of claim 72, paragraph (a) are adequately supported by the present specification as originally filed.

Figures 1 and 2 and page 5, line 24 through page 6, line 1 disclose a top sheet 14 of insulating material (an implicit feature of a printed-circuit substrate of this kind, and as supported by the last full paragraph on page 10 as noted above with regard to claim 67) wherein the top sheet 14 has a pattern of parallel top electrodes 16 thereon. Page 7, lines 13-20 of the instant specification disclose top electrodes on the sheet 14 being aligned with and facing the open tops of the channels and being attached by solder to the side electrodes to attach the top sheet to the print head and to close the channels at the open tops. These limitations are also shown in Figures 1 and 2. Therefore, adequate support can be found within the present specification as originally filed for each limitation of claim 72, paragraph (b).

Copied Claim 73

Claim 73 is copied from claim 10 of the Kodak patent. Claim 73 recites that the top sheet or closure sheet and top electrodes extend beyond the sheet of piezoelectric material in a direction parallel to the channels. Figure 1 of the present specification shows the top sheet 14 and top electrodes 16 extending beyond the sheet of piezoelectric material 12 in a direction parallel to the channels. This is also supported by page 5, lines 6-8 of the specification which specify that Figure 1 shows a longitudinal section of the droplet deposition apparatus. Therefore, adequate support for the limitations of claim 73 is found in the specification as originally filed.

Copied Claim 74

Claim 74 is copied from claim 12 of the Kodak patent. Page 2, lines 20-26 of the present specification disclose a method of making a piezoelectric ink jet print head including the steps of forming a sheet of piezoelectric material poled in a direction normal to the sheet and defining a plurality of parallel channels mutually spaced in an array direction normal to the length of the channels. This portion of the present specification also discloses that each channel is defined by facing side walls and a bottom surface extending between the respective side walls whereby each of the side walls includes side electrodes on opposite sides thereof in order to form shear mode actuators for effecting droplet expulsion from the channels (also see page 5, lines 18-20). Each side electrode extends along the length of the corresponding side wall, implicitly found in Figure 2 and explicitly described at page 7 lines 2-3 of the present specification. Therefore, claim 74, paragraph (a) is adequately supported by the present specification as originally filed.

Page 3, lines 2-4 and Figure 2 of the present specification disclose forming a top sheet or channel closure sheet of insulating material (an implicit feature for a printed-circuit substrate of this kind and further supported by the last full paragraph on page 10) wherein the top sheet has a pattern of parallel top electrodes or parallel conductive tracks that are arranged congruent with the tops of the channels in the sheet of piezoelectric material. Therefore, the limitations of claim 74, paragraph (b) are adequately supported by the present specification as originally filed.

Page 7, lines 16-20 disclose bonding by reflow soldering the top sheet to the sheet of piezoelectric material so that the top electrodes are attached to respective pairs of the side electrodes and to close the open tops of the channels. Therefore, adequate support for the limitations of claim 74, paragraph (c) can be found in the specification as originally filed.

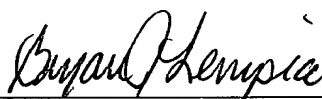
Further, support for combining each of these method steps can be found at the recited pages and line and in that the completed apparatus of Figures 1-3 is formed utilizing the method steps.

CONCLUSION

According to the present amendment and to the examiner's agreement to rejoin method claims 20-33, 70, 71, 74, and apparatus claims 79 and 80, the present application now includes pending claims 20-45 and 59-80. Each of these claims is now believed to be in condition for allowance.

The applicants await early and favorable consideration of the matter. The examiner is invited to contact the applicants' below-signed representative if anything further is necessary to place this case in condition for allowance.

Respectfully submitted,
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